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THE CENSUS OF THE GAS INDUSTRY.

It is desired to return thanks to the several hundred gas managers and officers of companies who have so promptly sent in their returns for this branch of the census, and especially for the completeness of the answers. In many instances it is doubtless difficult to give the information asked for regarding former years, from loss of records, want of proper care in keeping accounts in the earlier days of the industry, etc. In such cases, statements should be made from the best information to be had. The statistics for 1880, however, should be fully and accurately stated so that this, the first complete record of the magnitude and importance of the industry may be thoroughly reliable. To those who have not yet forwarded their returns, it is respectfully suggested that the matter receive as early attention as possible,

G. W. DRESSER,
Special Agent, etc.

ELECTRIC LIGHTING.

There is nothing especially new in the practical application of the electric light. There are six or eight companies formed in New York city, with different systems of generating and using the current, for the purposes of illumination. The large lights furnished by the arc system continue to glow on Broadway, from 14th street to 34th street, from sunset to sunrise—there being about 23 lights on this mile of street. The lights seem to burn quite well, although they sometimes go out, as on the 5th inst., for half an hour or so.

The power used for these lights is about one horse power per lamp. Quite a number of private consumers are supplied along the line for one dollar per lamp, per evening, up to 12 o'clock. There are several other arc lights in use at various points, where the proprietors are desirous of demonstrating to the public that they are prompt in adopting all modern improvements. These are usually supplied with power by engines located near-by, and the capacity of the engines often has a material effect upon the light.

In one large establishment, where a number of lights had been in use for some time, but where circumstances required the use of some gas at times, the question was asked what the saving was. The prompt reply was, "we save more than three-quarters of our gas bills"; but upon further questioning as to the entire cost of lighting the establishment, the fact was admitted that, considering the cost of everything, the expense of lighting was no less than formerly by gas alone.

As to the incandescent system of electric lighting, there are four places now lighted in this way; but the cost of lighting does not transpire. It is understood that, in a majority of the cases, the establishments are those of parties interested in the stock of the electric light companies. The establishment from Menlo Park has taken new quarters, in a large mansion on Fifth avenue, but, as yet, have not commenced furnishing customers with light.

On the 30th of this month bids will be made for the lighting of the public streets of this city, and it is possible that, on that occasion, the price at which various companies are willing to undertake public lighting by electricity may transpire. The gas companies are now lighting the street lamps, taking care of the lamps, and lighting and extinguishing, at fifteen dollars per lamp for 4000 hours per annum.

Whether they will undertake the work for another year at so low a figure cannot be known until after the bids are opened; but it is not at all probable that the price will be any lower.

So far as the manufacture of gas is concerned it is not at all probable that the use of the electric light will have any but a beneficial effect upon the business.

The uses of gas are by no means exhausted; but, on the other hand, the possible development of the business is enormous. All that is needed is the application of ordinary business principles, the cheapening of cost of production, and the extension of its uses, and the gas business will continue to grow and prosper. Handle the coal by machinery, and as few times as possible, burn it off in furnaces constructed on economical and correct principles, save the residuals, and create a market for them if necessary, and the gas maker can offer his product at such prices as will defy competition. As matters stand at the present time, kerosene oil is by far a more formidable rival than electric lighting, and cheap gas is the best antidote for existing ills.

[A Lecture delivered, Thursday, January 27th, at Glasgow, under the auspices of the Science Lecture Association.]

Gas and Electricity as Heating Agents.

By Dr. C. W. Siemens, F.R.S., Etc.

[Continued from page 98.]

When, in the early part of the present winter, London was visited by one of its densest fogs, many minds were directed towards finding a remedy for such a state of things. In my own case it has resulted in an arrangement which has met with a considerable amount of favor and practical success, and I do not at all hesitate to recommend it to you also for adoption. One arrangement of this grate is here represented.* The iron dead plate, *c*, is riveted to a stout copper plate, *a*, facing the back of the fire grate, and extending 5 inches both upwards and downwards from the point of junction. The dead plate, *c*, stops short about an inch behind the bottom bar of the grate, to make room for a ½-inch gas pipe, *f*, which is perforated with holes of about 1-16th of an inch, placed at distances of 1½ inches along the inner side of its upper surface. This pipe rests upon a lower plate, *d*, which is bent downwards towards the back, so as to provide a vertical and horizontal channel of about one inch in breadth between the two plates. A trap-door, *e*, held up by a spring, is provided for the discharge of ashes falling into this channel. The vertical portion of the channel is occupied by a strip of sheet copper about four inches deep, bent in and out like a lady's frill, and riveted to the copper back piece. Copper being an excellent conductor of heat, and this piece presenting (if not less than ¼-inch thick) a considerable sectional conductive area, transfers the heat from the back of the grate to the frill-work of the vertical channel. An air current is set up by this heat, which, in passing along the horizontal channel, impinges on the line of the gas flames, and greatly increases their brilliancy. So great is the heat imparted to the air by this simple arrangement, that a piece of lead of about half a pound in weight introduced through the trap door in the channel melted in about five minutes, proving a temperature exceeding 619°F., or 326°C. The abstraction of heat from the back has, moreover, the advantage of retarding the combustion of the coke there while promoting it at the front of the grate.

This fire-place was set up at my office, which is a room of 7200 cubic feet capacity facing the north. I always found it difficult during cold weather to keep this room at 60°F. with a coal fire, but it has been easily maintained at this temperature since the grate has been altered to the gas-coke grate just described.

In order to test the question of economy, I have passed the gas consumed in the grate through a Parkinson's 10-light dry gas meter, supplied to me by the Woolwich, Plumstead, and Charlton Consumers' Gas Company. The coke used was also carefully weighed. The result of a day's campaign of 9 hours was a consumption of 62 cubic feet of gas and 22 pounds of coke—the coke remaining in the grate being in each case put to the debit of the following day. Taking the gas at the average London price of 3s. 6d. per 1000 cubic feet, and the coke at 18s. per ton, the account stands thus for 9 hours:

62 cubic feet of gas at 3s. 6d. per 1000 feet	2.604d.
22 lbs. coke at 18s. per ton	2.121d.
Total	4.725d.

or at the rate of 0.525d. per hour. In its former condition, as a coal grate, the consumption generally exceeded 2½ large scuttles a day, weighing 19 lbs. each, or 47 lbs. of coal, which at 23s. a ton equals 5.7d. for 9 hours, being 0.633d. per hour. This result shows that the coke-gas fire, as here described, is not only a warmer but a cheaper fire than its predecessor; with the advantages in its favor that it is lit without the trouble of laying the fire, as it is called, and keeps alight without requiring to be stirred, that it is thoroughly smokeless, and that the gas can be put off or on at any moment, which in most cases means considerable economy.

A second and more economical arrangement as regards first cost consists of two parts which are simply added to the existing grate, viz.:—(1) a gas pipe with a single row of holes about 1-16th inch diameter, 1.5 inches apart along the upper side, inclining inward, and (2) an angular plate of cast iron with projecting ribs extending from front to back, on its under side, presenting a considerable surface, and serving the purpose of providing the heating surface produced by the copper plate and frill work in my first arrangement. In using iron instead of copper, it is necessary, however, to increase the thickness of the plates and ribs in the inverse ratio of the conductivity of the two metals, or, as regards the back plate, from ¼-inch to ⅜ inch. An inclined plate fastened to the lower grate bar directs the incoming air upon the heating surfaces, and provides at the same time a support for the angular and ribbed plate, which is simply dropped into its firm position between it and the back of the grate. The front edge of the horizontal plate has vandyked openings, forming a narrow grating through which the small quantity of ashes that will be produced by combustion of coke or anthracite in the grate discharge themselves down the incline towards the back of the hearth, where an open ash-pan may be placed for their reception.

In adapting the arrangement to existing grates, the ordinary grating may be retained to support the angular plate, which has in this case its lower ribs cut short to the level of the horizontal grate.

A considerable number of grates have now been constructed or altered in accordance with my plan, and have given great satisfaction to users, on account of convenience and economy, which are conditions essentially necessary, if we are to make any way towards the more important, I may say national result of a smokeless London, a smokeless Manchester, and a smokeless Glasgow.

But it may be asked—Are you sure that the coke and gas grate that you advocate will do away with fogs and smoke? My answer is that it would certainly do away with smoke, because the products of combustion passing away into the chimney are perfectly transparent. Mr. Aitken has, however, lately proved, in an interesting paper read before the Royal Society of Edinburgh, that even with perfect combustion a microscopic dust is sent up into the atmosphere, each particle of which may form a molecule of fog. We have evidence, indeed, that the whole universe is filled with dust, and this is, according to Prof. Tyndall, a fortunate circumstance, for without dust we should not have a blue but a pitch black sky, and on our earth we should be, according to Mr. Aitken, without rain, and should have to live in a perpetual vapor bath. The gas fires contribute, it appears, to this invisible dust, and we should, no doubt, continue to have fogs, but these would be white fogs, which would not choke and blacken us.

Granted the cure of smoke, it might still be questioned whether such a plan as is here proposed could be carried out on so large a scale as to affect our atmosphere, with the existing mains and other plant of the gas works. If gas were to be depended upon entirely for the production of the necessary heat, as is the case with an ordinary gas and asbestos grate, it could easily be proved that the existing mains would not go far to supply the demand. Each grate would consume from 50 to 100 cubic feet an hour, representing in each house a consumption exceeding many times the supply to the gas lights. My experiments prove, however, that an average consumption of from 6 to 8 cubic feet of gas per hour suffices to work a coke gas grate on the plan here proposed. This is about the consumption of a large Argand burner, and therefore within the limits of ordinary supply.—London *Journal of Gas Lighting*.

[To be Continued.]

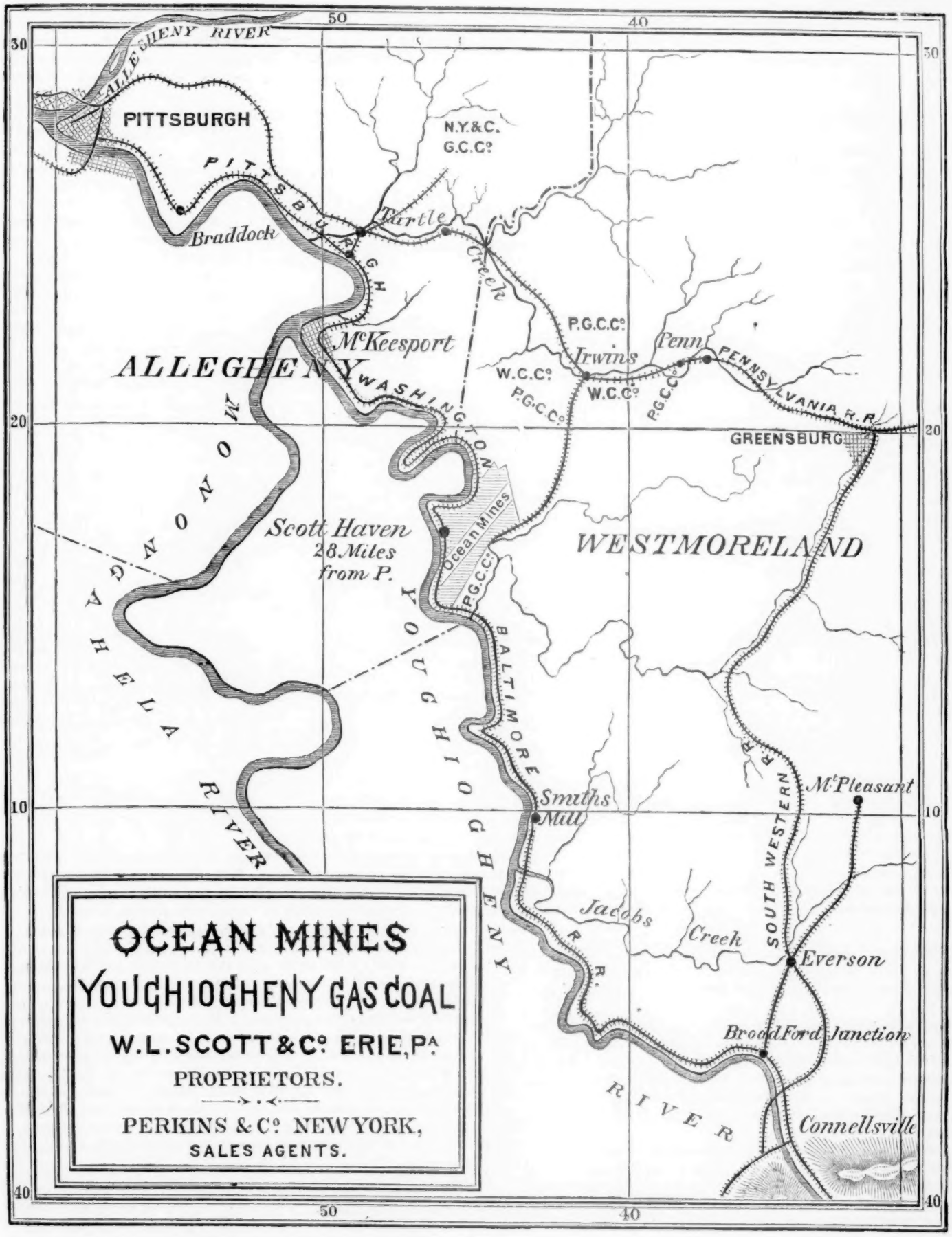
* A diagram was shown similar to that reproduced in the *Journal* of Nov. 23 last year, Vol. xxxvi., p. 807.

The City of London without the Electric Light.

The late severe weather caused a considerable amount of trouble to gas manufacturers and their consumers; but either the climate or something else has had a much worse effect upon the proposed illumination of the thoroughfares and bridges of the city of London by various systems of electric lighting, of which we heard so much last year.

This scheme hangs fire in a remarkable manner. At first it was to have been inaugurated last autumn; then it was announced that the first of February would see a gorgeous vision of tall lighthouses strung along the sidewalks, and superseding the gas lamps. Now it is said that the first of March was intended for the commencement of the new system, but that the late snowstorm and frost have so obstructed the preliminary work, that it is yet uncertain when the electric lamps are to make their appearance. Meanwhile the streets and bridges continue to be lighted by the doomed gas lamps; for, with an amount of discretion for which they are not always credited, the city authorities have not given the gas company positive orders to turn off the gas from the street lanterns on a fixed date, although, of course, unless they wish to go on paying for gas and electricity as well, the day will come when the services of the gas company will be dispensed with—for the time being.

The Corporation do not appear desirous to hasten the electric lighting contractors, who, we may hope, will give the public a good show after keeping them without it for so long. Perhaps, however, these astute persons are calmly waiting for summer previous to lighting up, in order to get settled to their work before next winter. There have not been any symptoms of popular discontent with the existing state of things, or of a yearning after a better arrangement; but the Commissioners of Sewers should bestir themselves, and get their experiment well forward before Mr. St. George Lane Fox, or some other electrician with equal experience in street lighting, brings forward a new system in order to upset Messrs. Siemens, Brush, and Jablochkoff together.—London *Journal of Gas Lighting*.



MAP SHOWING LOCATION OF SCOTT'S OCEAN MINE YOUGHIOGHENY GAS COAL.

The Ocean Mines now embrace an area of three thousand three hundred acres, giving a total capacity of *thirty-six million tons.*

They can deliver from 1,800 to 2,200 tons daily.

The Youghiogheny coal is now accepted as the *best American gas coal* obtainable, and the facilities of the Ocean Mine are not surpassed by any other colliery in the United States.

PERKINS & Co., *General Sales Agents,*

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[Official Report.—Continued from page 102.]

Eleventh Annual Meeting of the New England Association of Gas Engineers.

Held at Boston, February 16th, 17th, and 18th, 1881.

First Day—Morning Session.

NOMINATION OF OFFICERS.

The President appointed Messrs. Cabot, Norton, Bill, Coggshall, and Frost a Committee on Nomination of Offices of the Association for the ensuing year.

SECRETARY'S SALARY.

Mr. Stiness—Before that Committee retires for the purpose of preparing the list of nominees for office, I wish to suggest that an additional duty be placed upon them. It is well known that our Secretary performs a great deal of labor in the interest of the Association, and it seems to me that he should, to a certain extent, be compensated therefor. Mr. Neal knows nothing of what I am about to state. I make the suggestion as applicable not only to the present incumbent, but also to those who may follow him. We may sometime be called upon to elect some one else to fill that position who may not have the time or opportunity to perform the duties of the office as Mr. Neal has done. We find that he is many times compelled to use his own funds in payment of some of the current expenses of the Association. I move that the Committee appointed to nominate officers for the ensuing year be requested to name a sum which shall be paid the Secretary and Treasurer by way of salary for the ensuing year. I think it is no more than just that we should pay him a certain sum. The Secretary is not always able to do all the work himself, and is obliged to hire a portion of it done. I do not think we should put all the work upon the Secretary and then fail to reimburse him for what he is actually obliged to pay out. I am not in favor of paying a large salary, but I think that some sum should be paid him.

The Secretary—I have no desire for any salary. I do not know that I shall be re-elected; and I will say now, before the nominations for the ensuing year are made, that I am perfectly willing to retire from the office if any one else may be found to take the position. It is a position which requires a great deal of time and labor—more than anyone would suppose in so small an association. There is a great deal of correspondence; there are papers and pamphlets to be sent out, the distribution of which requires a great deal of patience and time. I have been entirely satisfied with the salary which I have received thus far, and shall continue to be satisfied with it if re-elected. As I said at the last meeting, I do not want the Association to feel that I have a life lease of the office. I am ready to retire at any time, and shall not feel at all hurt by being displaced by some one else. I do not think that anyone has less time than myself to attend to the duties of the office; I have to make the time by foregoing recreation if necessary.

The motion of Mr. Stiness was agreed to, and the Nominating Committee was instructed to consider and report an adequate salary to be paid the Secretary for the ensuing year.

GAS LIGHTING.

The President read an invitation from Mr. George Endicott, President of the Automatic Gas Lighting Company, inviting the members of the Association to visit the works of the company and inspect their method of gas lighting.

Mr. Moore—We have been using this method of lighting for several months in Salem, and have 6,000 feet of wire attached to 75 lights. Thus far the method has worked successfully in lighting the burners, but it is not always successful in extinguishing them, owing, I suppose, to the pipes being stopped up. In the summer time it would no doubt be successful, but in the winter, because of the stoppages in the pipes, it does not always operate successfully in extinguishing.

On motion, it was ordered that the thanks of the Association be returned for the invitation, and the President of the Company be informed that it would be impossible for the Association, as a body, to accept the invitation, but that the individual members would avail themselves of the privilege given at some time convenient to the gentlemen interested.

The Association then took a recess until 3 o'clock P.M.

First Day—Afternoon Session.

The Association was called to order by the President at 3 o'clock.

ELECTION OF OFFICERS.

Mr. Cabot—The Committee on Nomination of Officers for the ensuing year would respectfully report the following list of candidates:

President—William A. Steadman, Newport, R. I.

Vice-Presidents—A. B. Slater, Providence, R. I.; M. S. Greenough, Boston, Mass.

Directors—John P. Harbison, Hartford, Connecticut; John Andrew, Chelsea, Mass.; J. H. Rollins, Worcester, Mass.; Oliver E. Cushing, Lowell, Mass.; Charles F. Warren, Manchester, N. H.

Secretary and Treasurer—George B. Neal, Charlestown, Mass.

In regard to the salary of the Secretary, the Committee felt that the Association was not in a condition to pay the Secretary any sum which would be sufficient to properly compensate him for his labors, and they therefore recommend a payment to him of $25 per year for his incidental expenses.

On motion of Mr. Stiness, the report of the Committee was received and the nominations unanimously accepted.

The President appointed Mr. Gerould a committee to cast the ballot of the Association in behalf of the nominees, and there being no objection, the gentlemen above named were thereafter declared unanimously elected as officers of the Association for the ensuing year.

The President—I think this method of electing officers is unparliamentary, and so I suppose I may be indulged the unparliamentary step of declaring the election, although I am one of the officers named in the list. It is not exactly right to vote in this way, because it deprives members of their privilege of expressing a preference for some other gentlemen than those named by the Committee. Of course it would be considered invidious for any member to express his dissent to the nominations in the presence of the nominees. I think, on many accounts, that it would be advisible for us to spend the time to cast ballots in the usual way. It is quite possible that some members may take exception to something that I may have done or left undone while acting in my official capacity, who would like to express his disapprobation by casting a ballot against me; and he should have the opportunity for doing so. This he cannot do if one member is appointed to cast the ballot of the entire Association. If, however, it is your pleasure that this vote shall stand as it has been cast, I will declare the officers as nominated duly elected.

I assure you, gentlemen, that I feel very grateful for this renewed expression of your confidence, and for the approbation of my official conduct implied by my re-election. I shall feel very happy indeed if, at the end of my second (and final) term of service I shall have so merited your approbation that you will say to me, at my retirement from office, "Well done." (Applause.)

Mr. Gerould—I move that the salary of the Secretary be as recommended by the Committee—that is, that he be allowed $25 per year for incidental expenses.

The President—I think it would be just as well if you put the motion in this form: That the Secretary and Treasurer be allowed the sum of $25 for the ensuing year, to cover the incidental expenses that may occur in conducting the business of the Association.

Mr. Stiness—It seems to me that that does not cover it. Our Secretary already receives his incidental expenses. If we vote this sum for his incidentals, it may be sufficient to cover only his actual postage. The effect of the resolution now suggested would be to limit his incidental expenses to $25 per year. That is insufficient. Of course, all of his incidental expenses should be paid by the Association.

Mr. Gerould—Then you had better make the payment as a salary—making no reference to incidental expenses. I will so modify my motion.

The motion of Mr. Gerould was unanimously adopted.

The Secretary—I am very much obliged to the Association for the confidence they have reposed in me by electing me for the eleventh time to the office of Secretary and Treasurer. I have not asked for any compensation whatever; I have rather declined it; but as the Committee has seen fit to force this large sum upon me, I accept it, with thanks. The fact is that the income which is derived from the small assessment of $3 will not allow a large salary to be paid—particularly when the actual and necessary expenses exceed the income, as they have done the past year. (Applause.)

Mr. C. H. Nettleton then read the following paper:

THE DIETERICH FURNACE.

In preparing this paper on the making of gas with a Dieterich furnace, I felt that I had nothing wonderful to write about—no great feat accomplished or battle won in the struggle of gas making, but rather that I had but a failure to record—a defeat, and almost a rout—and so I hesitated, and thought of how it would sound to come before you with a statement remarkable for nothing but a want of success. But believing that every failure has its lesson, and that my failure might be of assistance to others working in the same line as myself, and might prevent some waste of time and money, I resolved to overcome all personal feelings that I might have in the matter, and so prepared these notes.

In order that you may have a clear conception of the value, or want of value, of the work done, permit me to give you a slight sketch of the stack of benches in the retort house of the company with which I am connected. There are in the stack four benches of five retorts each, two back to back, with exceedingly poor protection on all sides for preventing the radiation of heat; so poor that, although using large retorts and good settings, the average yield per retort, with a coke fire, has never exceeded 6,000 feet, and with a tar fire never exceeded 7,000 feet.

The hydraulic main almost rests upon the top of the brickwork, there being a space of only 3 inches between it and the bricks. The standpipes are quite short.

On one side of this stack there was constructed during the summer of 1880 two of Dieterich's furnaces, and in the arches over them were placed two open settings of five retorts each, the four lower retorts being 14″×22″, and the upper one 15″×30″, all 9 feet long. The first furnace was fired Sept. 3, and on the 6th the retorts were charged for the first time. In a few days the yield per retort was run up to 8,800 feet, and was only stopped by lack of holder room. The yield per pound was over 5 feet.

In about two weeks from the time of starting trouble appeared in the shape of stopped standpipes, and from that time until the bench was let down the trouble never ceased. At times the stoppages were caused by pitch, at others soot or dry carbon, and often a combination of both.

The stoppages were at all points of the stand, bridge, and dip pipes, and occurred at the commencement, during, and at the end of the charge. The men were absolutely worn out trying to keep the standpipes free. Several times I have seen all five of the standpipes stopped at once.

Not long after this, pitch accumulated in the hydraulic main, especially under and around the centre dippipe, and it became exceedingly difficult to make a passage so that the gas could escape to the upper part of the hydraulic. The trouble increasing, it became necessary to take off the ends of the hydraulic and remove the pitch. This latter operation was frequently repeated as long as the bench lasted.

This pitch was productive of two evils: by causing a heavy back pressure it lessened the quantity of gas produced through leakage, and also caused the carbon to accumulate rapidly; and this last not only diminished the size of the retorts, so that the full size charge could not be run, but also rendered frequent scurfing necessary, with its consequent wear on the retorts.

In addition to the other troubles, a number (nearly half) of the retort bolts burnt off in the retorts, so that four out of the five mouthpieces fell away from the retorts from half an inch to two inches. The burning of the bolts was due either to high heats or poor iron; probably both.

During the months of November, December, and January, owing to want of holder room in proportion to the consumption of gas, the bench was run very irregularly, being crowded hard every week from Monday night to Saturday night, and then charged irregularly till Monday night again. This, combined with high heats and the frequent scurfing, caused the retorts to crack and sag badly, and the middle of January found the bench sadly broken down.

At this time, the pitch having accumulated in the hydraulic worse than ever before, I resolved to have a final cleaning out, and then, by lowering the heats, to try to make the bench last a few months longer. Three good men worked for seventeen hours trying to remove the pitch from seven feet of hydraulic main, and as a result of their labor half of the pitch, and not more, was taken out; and then, by trying to patch the retorts, only two could be made passably tight, the other three being hopelessly broken down.

And so ended my glowing hopes of a long life and magnificent results from my first bench heated by gaseous fuel. They were born September 6, 1880; they died, "overcome by heat," January 17, 1881, aged four months eleven days and a few hours.

In this connection it may be of interest to record the short time in which the second furnace was fired up. In twenty hours from the time a fire was started in the furnace the retorts were each charged with 100 pounds of coal, and in twenty-four hours with 200 pounds each; and after that they run regularly on 4-hour charges. This seems to me to show the power of the furnace to produce heat more than all that I have previously stated.

In regard to the results obtained. The great point claimed for this furnace is that large charges can be burnt off in three hours. This result I was unable to reach. I tried several times to charge every three hours, and the coke would come out half burnt, and the number of stopped standpipes increased. It seems almost a paradox that with a yield probably not much above 4 feet per pound there should be trouble from stoppages in the standpipes. According to our general understanding of that subject, when there is a heat sufficient to produce a stopped standpipe, there ought to be a heat sufficient to produce a larger yield than the one named.

There was little or no difficulty in making 8,500 feet per retort, running four-hour charges, but when forced to 9,000 feet or above the trouble immediately commenced, as I have described, in the shape of pitch and dust.

The percentage of coke used varied with the size of the charges, and was never less than 36 per cent., and averaged, when running 300 pounds per retort, from 38 to 40 per cent, The yield per pound for the four months in which the furnace was at work averaged 4.83. (This is taken from the average of all the gas made. The probability is that the yield produced by the furnace was higher than the figure given.)

The candle power, by a Jones jet photometer, taken at the office, half a mile from the works, averaged 16.87 candles for the four months, the percentage of cannel being 3.8.

The caking coals were a mixture of Westmoreland, Scott's Ocean, and Montauk—principally Westmoreland.

The small quantity of cannel employed to produce the result convinces me that a richer gas can be made when generated rapidly than when done slowly.

The results actually obtained for the thirty days of November were as follows:

Yield per retort	7,973
Percentage of coke used	41
Yield per pound	4.86
Percentage of cannel	5.4
Candle power by Jones' jet photometer	17.3

For the causes of the stoppages in the standpipes, and the formation of pitch in the hydraulic, I can only give you my theories. The stoppages in the standpipes from the soot were due in some way, I think, to an excess of heat in the retort in proportion to the amount of the coal carbonized. The gas, after being generated, was dismembered, and free carbon or incident soot produced.

The cause of the enormous accumulation of pitch in the hydraulic must have been due, I think, to the great heat to which the hydraulic main was exposed. As I have already stated, the main was very close to the bricks on top of the bench, and the space between was filled up with an accumulation of dust and tar, so that the heat from the bench was conducted readily to the tar in the main. The tar, standing essentially still in the hydraulic, was heated for a long time very hot, and probably the larger part of the lighter constituents were driven off, and only the pitch left.

If the space under the hydraulic had been kept open, the air would have circulated freely, and there would have been a tendency to have kept the main, and consequently the tar, colder. Had that been done, a portion of the trouble would, I think, have been avoided.

Such are my theories for the causes of the two most serious difficulties I met with, and you must take them for what they are worth.

In running the second bench, I have had a chance, for a short time, to experiment on these theories, and I find that the results partially sustain them.

The heats have been kept down so as to produce less than 5 feet, and generally less than 4 80, and there has been comparatively little trouble from either soot or pitch while running on both four and three hour charges.

Last week, with the view to giving the results at this meeting, the retorts for four days were charged very regularly every three hours with 1,300 pounds of coal, or 260 pounds per retort. The coke saved was carefully measured. The results are as follows:

	Yield per Retort.	Yield per Pound.	Percentage Coke Used.
1st day	9,277	4.46	41
2d day	9,546	4.58	33
3d day	9,485	4.56	33
4th day	9,953	4.98	34

At the end of the week, I found there had been a daily average of twelve stopped standpipes, mostly from soot, and that a small quantity of pitch had accumulated in the hydraulic, although the space under the hydraulic was kept clear.

As this is an improvement over any work I have ever done before, I feel convinced that I am working in the right direction, although the stoppages and the pitch show me that I am far from perfect working yet; and so I have hopes that sooner or later I may learn how to run the furnaces so as to produce 11,000 feet per retort and 5 feet per pound, without pitch and without stopped standpipes.

That the Dieterich furnace has great power in producing heat, there can be no question. That it has produced, at the works in my charge, much more gas per retort, and with less fuel than by the old method, I know positively. That it can be made to work well, or rather magnificently, the results at Baltimore and Providence prove beyond a doubt, and therefore I am forced to the conclusion that the want of success I have met with is not the fault of the furnace, but is due to a lack of proper management—or, in other words, is my own fault.

Mr. M. S. Greenough—Mr. Nettleton has graphically told us of the experience of his company in the use of this furnace, and the experience of other companies will doubtless prove interesting. In some respects the experience of the Boston Gas Company is similar that of his company, and in other respects it differs from it. As the Association will remember, a year ago we announced our intention of making an experiment with the Dieterich furnace on a sufficiently large scale to enable us to determine its merits, because we believed it promised better on the whole than any other furnace of which we knew. We had hoped to get our furnaces at work by the early part of the summer, in order that during one or two of the summer months we should be able to make all our gas by the Dieterich furnaces, and be able to tell exactly where we stood. Owing to one cause or another, that anticipation on our part was not realized. It was not until October that we were able to fire any of the sixteen benches that had been altered over to this plan. We knew that elsewhere there had been difficulties in working off the quantity of coal per retort which we had been led to understand that we could handle. Therefore our attention was from the first directed to the effort of getting as high a heat as possible from the benches which we had working. We had been going but a few weeks before we had increased the charge per retort gradually from 2400 pounds for 12 retorts every 3 hours up to 3600 pounds every three hours—working off 300 pounds of coal per retort every 3 hours, and the coke coming out without a foot of gas left in it. The retorts were $9' \times 15'' \times 26''$. Ordinarily we charge those retorts with 261 pounds of coal every 4 hours. With the Dieterich furnace we could work off 300 pounds every 3 hours. During the time the retorts were charged in that way we must have been making from 12,000 to 13,000 feet of gas per retort. We had done that but a very short time before we began to enjoy the experience to which Mr. Nettleton has called your attention. We were previously almost ignorant of the amusement which can be derived by cleaning out a stack of standpipes. Now we appreciate it. We have also experienced the difficulty which results from the stopping of our hydraulic mains with pitch. We were obliged to clean our hydraulic main; to devise various ingenious methods for cleaning our standpipes; and then to lower our heats and start afresh. That is as far as we have got. I am not to-day prepared to say anything against the Dieterich furnace. Neither am I prepared to commend it as a measure to be adopted by all the companies represented here. We have now 16 fires going. We are running our retorts at such a heat that I presume we are making something more than 10,000 feet of gas per retort. The retorts are now working much better. Our stoppages are comparatively infrequent, and we are having little if any difficulty with the mains. We are using about one third of the coke, and we are doing our best to get as *little* heat as possible from it, rather than as much as possible. I think the result, of which Mr. Nettleton has just spoken, is worthy the attention of the Association. He spoke of the stoppage of his standpipes when the heats were low. We have had some experience of that same kind. It was only this morning, on my having occasion to criticise the appearance of the coke which I saw being drawn from some of the retorts heated in this way, that the foreman of the retort house informed me that in that very bed four standpipes had stopped the previous night, although the yield from that coal must have been much less than we are taking from other coal of the same kind in the rest of the retort house, without having any difficulty whatever from stoppages. I shall be very glad to hear from any gentleman a theory that will fit that case; but that is the fact.

Two or three facts have been evolved from our experiments. One fact is that a very much greater heat can be obtained from a much less quantity of coke than we are ordinarily using. Perhaps that is not putting it exactly right; I mean that with much less coke than we are now using we can produce much more heat than we ordinarily get. Certainly, with 30 per cent. of the coke which we make we can get a great deal more heat than we can possibly use in the old way.

A second fact which we have ascertained is that there is a limit to the production of a retort; that after you put into a retort more coal than can properly be carbonized by that size of retort, in order to work the gas from it you have got to subject that coal to such a great heat that the gas will be disorganized, and you will have trouble both with your gas and with your tar. I think these two facts are very evident. At least, they are indicated as the result of our experience thus far. I do not feel that the four months we have occupied in experimenting with this furnace have been at all thrown away. I think that the money we have expended in excavating the cellar and in building the furnaces has been money well invested. If this system of furnace does not work, I am satisfied that some similar furnace will. It is extremely probable that after we have gone a little further we shall find that the same good results which have attended the use of the Dieterich furnace in Providence and Baltimore may be attained by us.

There is a third fact (or at least opinion which I have formed), which is, I think, worthy of consideration. In working these furnaces we have not found that, by charging the retorts more heavily, and working off so much more coal, we have been able to obtain a corresponding saving of labor. If others have found a different result, it is their good fortune. We have found that the increase—the larger amount of coal that had to be handled every three hours—has increased the labor, and that the increase in labor is almost exactly proportioned to the increased amount of coal that we have to handle. We have not been able to reduce our labor account, as might, perhaps, have been expected; and until some system of stoking shall be devised which will enable a company to substitute steam for manual labor, I doubt whether there will be any very great decrease in the labor account from the use of a furnace of this nature, although there will undoubtedly be a very considerable decrease in the amount of coke which is used. If the Ross stoker, or the stoker invented by Mr. West (who is now in charge of the Manchester works, England), should come into use, then there would be a very great decrease in the cost of handling that quantity of coal. I think that the Ross stoker would save much more than the West stoker. If we can make that stoker work, and if instead of 250 pounds every 4 hours we can charge with 300 pounds every 3 hours, and put the coal into the retorts by steam power instead of by manual labor, then we shall have taken a long step toward the solution of the problem to which our President referred this morning. That is the result of our trial of the Dieterich furnace. I shall be very glad to hear from someone who has had better luck with it

Mr. Slater—We have not yet had sufficient experience with the Dieterich furnace to be able to judge very exactly what it is capable of doing. We have been using it only two months and a half. The benches were first fired on the 26th of November. Instead of getting ready to charge in three days, as Mr. Nettleton did, we were a little more than a week. Thinking that I might perhaps be asked the results that we have obtained from the use of the furnace, I took some data from the books before leaving home. I have a statement covering 53 days—from Dec. 9 to Jan. 31. We first started four of the furnaces; on the 28th of December we started two more benches, and on the 11th of January two additional benches, making eight furnaces in all. That is the full stack. I cannot state exactly the kind of coal used. Last year we put in two or three different kinds of coal, and the results which I have here were obtained from a mixture of these several kinds. The general result, so far as we can get at it in connection with the other benches, is as I will state. When we first fired up, we had eight benches of retorts running in another stack. When those were started, we started four of these. I am able to give the average yield of the whole number of benches running:

The largest percentage of coke used for any one day was	32.48
The smallest	18.42

For 10 days it was over 29 per cent.
For 11 " " 25 " and less than 29 per cent.
For 27 " " 20 " " " 25 "
For 6 days it was less than 20 per cent.

After the 10th of January it never came up to 22 per cent. for the remainder of the month.

The charges have all been three hour charges.

The smallest charge in any one day was	211 pounds.
The largest " " "	293 "
The average charge for the whole time was	262½ "

The yield per pound, with the other benches running, calculating the average yield for the whole, was—

Largest yield	5.39
Smallest "	4.62
Average "	4.82

The yield per retort (Davison's) was as follows:

The smallest	8,037
The largest	12,057
Over 8,000 and less than 9,000	4 days.
" 9,000 " " 10,000	18 "
" 19,000 " " 11,000	25 "
" 11,000 " " 12,000	6 "
" 12,000	1 "

Before we started the Dieterich furnaces we were using from 12 to 14 per cent. of American cannel. Immediately on starting the Dieterich furnaces, or very soon after, the candle power ran up so that we were able to reduce the cannel down to 2 or 3 per cent., and we may, in time, be able to do without the cannel entirely.

Major Dresser—What is the size of your retort?

Mr. Slater—They are known as the Davison retort—about 30 inches in diameter.

Major Dresser—About what is the floor surface of the retorts?

Mr. Slater—I am not able to state exactly. The floor surface is a little more than that of the ordinary retort—15 in. by 26 in.

Major Dresser—About equivalent to 15 in. by 26 in.?

Mr. Slater—It would be a little more than that.

Major Dresser—How about the hydraulic main and the standpipes?

Mr. Slater—In that stack we are using what is known as the Stanley main. We have not had any trouble with it. We have not had the stand pipes stopped during that time. We have been troubled slightly with a thick tar; it is not exactly pitch.

Major Dresser—How do you find the labor, with reference to this additional amount of coal?

Mr. Slater—We have not taken so much notice of that. We have been running these in connection with the other benches, and we have not figured up the labor.

Major Dresser—Has your labor increased generally?

Mr. Slater—No; I do not think that it has. When we are able to run these stacks alone we shall be able to get all of these facts.

Major Dresser—Did you have any trouble with the benches getting too hot?

Mr. Slater—We might have had trouble if we had not taken pains to regulate the heat. I know that several parties who have put in these furnaces have had trouble. We have kept the heats back a little, as we always do. I never allow a bench to be fired up so as to be ready to be charged in less than three or four days. We are usually from a week to ten days in getting ready. We fire up very slowly. We never force a bench until it has been in use for quite a little time. I think that the secret of prolonging the life of a bench is in its careful use for the first few weeks or months.

Mr. Sherman—How do you account for the increase of candle power?

Mr. Slater—I do not know that I can account for that exactly. That yield is a little less than the yield that we obtained afterward. We were previously running a little over five feet on the average. This is less than the average of five feet. When the benches are running by themselves, I think the yield will be found to be larger than is stated here. When we get into the standard American coal the result will be better than I have stated.

Mr. Sherman—What candle power do you produce?

Mr. Slater—We run on an average about seventeen.

Mr. Sherman—You have no idea that it will produce better candle power than any other heat?

Mr. Slater—I do not know that there is any reason why it should.

Mr. Flemming—Hqw many bushels of coke do you get to the ton of coal?

Mr. Slater—We do not usually measure the coke. In ordinary coal there is about a chaldron of coke to a ton of coal. We figure it in that way. That would be about 36 bushels per ton.

Mr. Flemming—Do you base your percentage on that?

Mr. Slater—No; these percentages are all measured. The percentage of coke is all measured up and kept separate by itself.

Mr. Harbison—Before you started the Dieterich furnace you had an average yield of over five feet per pound; now, in using the Dieterich furnace, does your average yield come down to 4.80?

Mr. Slater—Yes; perhaps I ought to say that on the old benches we were using a higher heat than on the Dieterich retorts. We were using tar fires.

Mr. Harbison—You have not kept up the yield on the old benches to what you were doing before the Dieterich furnace was started?

Mr. Slater—Since that time we have been burning coke in the furnaces.

Mr. Harbison—But your yield would not now be what it was before the Dieterich furnace was put in?

Mr. Slater—I think not, for we were using tar fires at that time. There are so many different conditions to be taken into consideration, that it is difficult to bring all these things down to a fine point unless you have special experiments made.

Mr. Harbison—How long after starting the fires in the Dieterich furnace are you ready for charging?

Mr. Slater—About 24 hours. We heated the benches for three or four weeks before that. Now these benches which have been let down can be fired so as to take a charge of 200 pounds in the 24 hours.

Mr. Harbison—I ask that question because Mr. Nettleton reports his experience with his retorts sagging and cracking; and it might be presumed that that came from having too high a heat so soon after starting the fire in the bench. If in Mr. Slater's working the retorts were ready for charging about the same length of time after starting the fire as Mr. Nettleton's were, and the retorts did not break down with Mr. Slater, the rapidtty of heating might not be the reason for the breaking down.

Mr. Slater—The reason for the breaking down was probably the intense heat that was gotten up. The heat is so great as to take the life entirely out of fire-brick material.

Mr. Greenough—When our furnaces were built they were built with walls which were about 2 ft. 6 in. through. The fires eat right through the walls after they had been going six or eight weeks. I never saw such a heat as could be got from one-third of the coke that was made.

Mr. Slater—They cut through the two feet of solid masonry in the furnace?

Mr. Greenough—Yes, sir.

Mr. Nettleton—I have here some samples of the pitch taken from the hydraulic main. When this was taken from the main it had the appearance of cannel coal, and had a white or greyish lustre. It was about as hard when taken from the main as it is now. It cuts like cannel coal.

Mr. Harbison—Could it be used instead of cannel coal?

Mr. Nettleton—I think not.

Major Dresser—I was in Baltimore a few weeks ago, and called to see Mr. Dieterich. I had learned that there was some trouble in the use of his furnace, and I thought that I would find out what the trouble was. I suppose that the general inference to be gathered from his conversation was, that in days gone by, in the early history of this thing in his own works, he had found that there were tricks in managing this furnace; but he said that he had no trouble now; that he had got the thing so that he could work it right along very uniformly. I went through the retort house, and everything seemed to be working very comfortably. I copied from his book his working for the month of December. He had 20 benches of sixes, the retorts being 9′×12″×20″ each. Each bench was heated by a Dieterich furnace. There was no gas made at this station excepting what was made by those benches; so that it was a fair working experiment, on a good-sized scale, with no interfering circumstances. The amount of gas sent out from these 20 benches during the month of December was 29,989,000 feet. The yield per pound of coal was 4.98, or 11,144 feet to the ton. The highest yield per retort that I found on his books for any one day during that month was 9,133 feet; and the lowest yield was 7,300 feet; while the average of all the working for the month was 8,610 feet per retort per day. The amount of cannel used during the month was 67½ tons, which was about 2½ per cent. of the coal used. The amount of caking coal used was 2,623½ tons. The caking coal was West Virginia, similar to the Fairmount. They usually used the Fairmount, but for some reason they had got out of that. A great deal of this coal had come in wet, and was wet when it went into the retort house. The highest charge per retort during the month was 229 pounds; the lowest, 184 pounds; the average of all the charges in the month was 202 pounds per retort. The highest temperature of the air during the month was 54°; the lowest, 8° below zero. The highest temperature of the gas as it left the station meter was 64°; the lowest, 44°. The barometer was 30½, the highest; 29.9 the lowest. The illuminating power of the gas, as tested and reported by the city inspector was: highest, 18.90; lowest, 17.40; average for the month, 18.22 candles. The practical result of all this is that he is making more gas out of half of his retort house than the whole retort house was calculated to make, even supposing that every retort in it was running. The result is that all of his apparatus—purifiers, scrubbers, and everything else—are overworked. It is very evident that he has got to increase that part of his apparatus if he is going to run half of the retort house for which they were originally adapted.

Mr. Harbison—Does he run it all on 3-hour charges?

Major Dresser—He is running continuously on 3-hour charges.

Mr. Harbison—What is his experience on the labor question?

Major Dresser—He gave me his labor for the month. Of course, I am perfectly well aware that that is a matter which is nobody's business, so far as publication is concerned; but I know that he will not mind giving it to any one of you who may ask for it. It was very low—much less than by the old method.

Mr. Harbison—Can you tell us anything about the life of the retort?

Major Dresser—I cannot tell you anything about that. I merely took these figures off, as I thought they were a fair exhibit of the regular working under conditions that did not appear to have any unusual circumstances. In the previous accounts given he was hampered in various ways. He would have to shut down and stop making gas at times when the streets were not lighted; but he arranged for that by throwing the variation in supply all into the other works, and running these 20 benches right along steadily. It seems to me that in these returns there is encouragement for hope of the consummation of that expected 50 cents that your worthy President held up to you as the boon that every traveler has got to go for.

Mr. Harbison—Does he recommend the adoption of smaller retorts?

Major Dresser—No; I do not think he does. He put the furnaces under the retorts that he had. I asked him about the stopping of standpipes; his reply was a jocular one. He said that there was a little thing called an "augur," which would be found very convenient, and that it would be well to use it regularly; that if used thoroughly after every charge, there would be no trouble. At the same time, if you attempt to get too much out of your coal, the augur will not stop it. In other words, there is a point where you can work to advantage; but if you exceed that point, you are getting beyond the advantages, and trouble may result.

Mr. Slater—Is the stack of benches you are now speaking of a stack that has been rebuilt, or only refilled, with the settings renewed?

Major Dresser—It is the first stack as you go into the retort house; a portion of it had furnaces under it before.

Mr. Slater—Did he rebuild the stack when the old furnaces were taken out?

Major Dresser—No; he did not rebuild the stack; he simply filled the arches.

Mr. Lamson—We are now in the midst of an experiment. We have great hopes for the future that, by some modification of this furnace, we may get some good results. After such a discouraging statement by Mr. Nettleton as to the results of his experiments; and after the experiments made by us, and after the statement from Baltimore of everything running so smoothly there—it is quite clear that we did not conduct our experiments properly. In this connection I wish to make a statement. Mr. Dieterich's foreman, Mr. Hand, showed us how to run our benches; and when I said to him that such a heat would cause a stoppage in the stand pipes, he replied that we "must not mind such a little thing as that; that they had as high as sixty stopped stand pipes per day in Baltimore!" (Laughter).

Major Dresser—I asked Mr. Dieterich about the stopped standpipes. He said that they had had them in the early history of the thing; but that they had now learned to manage it so that they had very little trouble. He said that they were not absolutely free from annoyance in their hydraulic main, but that by regular, systematic attention to matters which they had found out by practically working this thing, they were able to go right along without much annoyance; that with the responsibilities resting upon him in the care of two large works, and in supplying the city with gas, the thing went along so smoothly that he was free from anxiety, at least so far as the Scott street works were concerned; that they never gave him any anxiety at all; that if he had had the trouble that others had experienced with their stopped standpipes he would not have been able to leave the works for a moment, for he would not then have thought that it was safe: but that, as things were working now, he had no anxiety, and all things went along in a very satisfactory way. I think that his labor account is enough to satisfy any one that there was no great additional amount of trouble derived from that source, as there certainly would be if you had those excessive troubles. As additional experience is obtained we will know better how to adapt those furnaces to the settings where they are put in. Of course, it may be necessary to manage the furnaces differently in different localities. Patience and perseverance will probably straighten out all the difficulties.

Mr. Slater—Does Mr. Lamson run any more heat in the other benches than he has done in the Dieterich furnace?

Mr. Lamson—At first we ran a very much more intense heat in the Dieterich furnace, but now we are running the heat more nearly uniform with the other benches.

Mr. Slater—By running more heat in the Dieterich furnace would you not expect to find more difficulty with the stand pipes?

Mr. Lamson—I should expect to find more or less difficulty there. Then, again, should expect to find, with the heat reduced in the Dieterich furnace, that we were entirely freed from the stoppage of the standpipes and the stoppage of the hydraulic mains. That I have not been able to accomplish yet. I am speaking now entirely of the experiment; I do not give my own opinion. I do not want gentlemen to go away from here with the idea that while everthing is working so smoothly in Baltimore, we, in the midst of experiments, with precisely the same furnace, are having all sorts of trouble. I think it very likely that at Baltimore they have been all through this thing, and have gotten their stopped standpipes down to a minimum. I think that at first they had a good deal of trouble there. I judge so from what their foreman said. He made that statement to me as a sort of consolation.

Mr. Slater—Did you run the furnace with the furnace door wide open?

Mr. Lamson—We run them in every conceivable way that we knew how. We have tried closing the doors, and we have tried opening them. At one time we ran for quite a long while with the doors entirely closed; at another time we closed the dampers. We were trying various experiments continually. We started under the direction of Mr. Dieterich's foreman and, at first, ran as he directed. I think the whole secret is that you can get all of the heat that you want, and more too. The question is—after you have got all of that heat how will you control it?

Mr. Slater—When we first started the furnace Mr. Dieterich was there himself, also Mr. Hand, and the furnaces were started with the furnace doors wide open, and the draft flues were open about three inches. We ran a few days in that way. After a few days we began to see the flame streaming out of the stacks, as they do in ordinary benches. We ran so, I think, for two or three weeks, and then we began to experiment how to stop that. When we first commenced to charge them, anyone coming into the retort house, and standing even right opposite the stack, unless he felt the radiation from the bench, would not know that any gas was being made there, because there was no flame issuing from the chimneys. So far as the outward looks were concerned, you would think that no gas was being made there. Then we commenced experimenting to try to reduce this flame from the chimneys. We did not succeed until we closed the furnace door and opened the slides of the lower door about four inches. The furnace doors are made with slides, which can be regulated.

The President—Do you mean the door that covers the ash-pit?

Mr. Slater—Yes.

The President—That admitted air to aid the combustion?

Mr. Slater—Yes; they are right under the furnace, arranged in the usual way. We found, by having those slides open about four inches, and having the draft door open about two and a-half inches, that we got all the heat that we wanted, and, at the same time, there was no appearance of any flame issuing from the chimneys. By "draft-flues" I mean the hot air flues on the sides of the furnace.

Major Dresser—Did you stop the flame from issuing from the top?

Mr. Slater—Yes: we succeeded in stopping it.

Mr. Harbison—Are the Dieterich furnace door frames all made of the same size?

Mr. Slater—I think that so far they are all made of the same size.

Mr. Harbison—They would be of the same size in the furnace in Baltimore as in yours in Providence?

Mr. Slater—I think so.

Mr. Lamson—I think one difficulty is that the furnaces are too large. If the furnace was small in proportion to the retort we could then get a chance to drive the furnace. But when your furnace is too large for your setting it is a great deal more difficult to hold the heat back than to force it. I have an idea that perhaps the fault is with the size of the furnace. The whole trouble is that we cannot hold the fire back. You or I can go there, perhaps, and run them evenly; but the point is to leave ordinary workmen there who will be able to do it properly, so that when we are away for a short time those persons will not let the heat get away from them.

The President—I believe that Mr. Livesey proposes to put ten or twelve retorts to one furnace in order to utilize the great surplus of heat which he has there.

Mr. Lamson—Perhaps it will be possible to heat two benches with one fire; but until we have tried the experiment we cannot determine such matters accurately.

Major Dresser—You could easily try the experiment of reducing the size of your furnace by lining up one side of the furnace with firebrick set on edge, so as to reduce the capacity of the furnace.

Mr. Lamson—We are proposing to use up this summer in experimenting with these furnaces.

The Secretary—As Major Dresser has visited the works in Baltimore, and has seen them working under the best condition, I would like to ask him where is the gain or advantage in using them? I fail to see it just yet. Taking into account the additional cost of the furnace, and the royalty which must be paid, where is the advantage in their use? Is it in the saving of the coke, or is it in the saving effected in working three hour charges instead of four?

Major Dresser—I do not know what the royalty is; and I have only a general idea as to the cost of the furnace; but it seems to me that the statement which I made, that from one-half of Mr. Dieterich's retort-house, as originally constructed, he is making more gas than the whole retort-house was originally intended for, would answer that enquiry.

The Secretary—I did not so understand you.

Major Dresser—The point is to get the most gas possible from each square foot of retort house floor; and this seems to me to be a step in the right direction, as he is now getting from each bench double the quantity of gas that these benches were expected to produce when they were originally built. It is an advantage I should say of considerable importance.

The Secretary—Is there a saving of both coke and labor?

Major Dresser—The saving of labor will be more fully developed when you put in your mechanical stokers, which you have got to do.

The Secretery—In small works?

Major Dresser—Yes, sir; there must be a stoker made which shall be adapted to small works. I do not say there is any such stoker now; but some man has got to get it up. If you are going to sell gas for $1.00 per 1000, and at the same time pay dividends on your capital stock, you have got to have it. The saving in fuel is an advantage, though not so important to us in this country as it is in France and England, where the price of fuel is higher than here. But when we see it started as a fact, shown in accounts audited by the government auditors, and in official reports made to the government, in London, that the South Metropolitan Company obtained from their residuals, last year, seventy per cent. of the cost of their coal, it looks as though there was a chance for residual products here. There certainly is over there; and I do not see why we are so far off that we cannot be working towards that point. Seventy per cent. on cost of coal is a very good return for residuals. It helps the 50 cent business very much. I a d the manager of one of the large London gas works, what his gas cost

him in the holder. He said, "We do not figure it in that way; but we sell gas for three shillings, and we generally calculate that it takes a shilling to make the gas, a shilling to send it out, and a shilling to pay the dividends." (Laughter.)

The President—When we shall have brought our stockholders to the point of claiming only one-third of all the money we put in, the problem will be stilll more simplified. We have got to do that by inducing our stockholders not to increase the capital stock until we have attained the point where the consumption bears a proper ratio to the capital.

The Secretary—We have also yet to induce nature not to furnish quite so much oil.

The President—We do not care anything about the oil if we can get the price of the gas down.

Mr. Slater—It seems to me that one of the most important features of the Dieterich furnace is that it maintains a uniform heat all of the time. In ordinary furnaces, where they have to let down the fires to clinker and to cool down the retorts, of course very much heat is lost; but in the Dieterich furnace that is not necessary, and so a uniform, steady heat can be maintained all the time. The charging of the furnace with hot coke is another advantage. In an ordinary furnace we are using all the way from forty-five to sixty per cent. of coke; but, as I have stated, the largest percentage we have used so far in the Dieterich furnace was 32·48, and the least something over 18. Of course, it is hardly worth while to say what we expect to do with that furnace in the future. I have no doubt that when we get fresh, American standard coals, we shall get very much better results than now; on this point I hope to be able to report at the next meeting.

Major Dresser—When you say that you use from 40 to 60 per cent. of coke in your other furnaces—is that based upon the calculation of a chaldron of coke to a ton of coal?

Mr. Slater—Yes.

The President—It seems to me that theoretically this secondary method of combustion is as near perfect as anything that can be devised. It strikes me as being beautiful in its simplicity, and in the ease with which the necessary ingredients of combustion are proportioned to each other. I have forgotten whether the whole of the letter press matter in connection with that illustration was copied into our journal or not; but if it was, as Major Dresser says, you will see at once, from the experiment, that Mr. Livesey undertook to determine the exact amount of air which should be admitted for the proper combustion of a given quantity of coke. It was determined by taking the area of his flues and applying an anemometer to show the rapidity of the draft. In previous experiments he had found a great deal of difficulty in adjusting the dampers so as to give him the requisite amount of air. He overcame that difficulty in his new method by adjusting all of the aperatures to the right size to begin with, so that they do not need to be altered now at all. It is quite astonishing to us, who have been used to 4-feet furnaces, with a 16-inch opening in the bottom as an inlet for the air when obstructed by the grate bars, to see how very small an amount of air is really necessary for the proper combustion of the fuel. Of course, the combustion in only a partial one. The first combustion produces carbonic acid, then the carbonic acid partially deoxidizes, and this supplementary supply of air comes in above; and the more intensely that is heated, of course the less fuel it takes to keep up the intensity of the heat in the bench. I should judge that they have ventilated the matter very thoroughly, as they have been experimenting for three or four years. They have come to the conclnsion that they now have ascertained just what is ncessary to produce perfection of combustion. They have overcome the intensity of the combustion at the bottom, which has heretofore been destroying the brickwork; and the point they are after now is the more perfect heating of the supplementary supply of air that burns the gaseous fuel issuing from the chamber. If Mr. Livesey succeeds in doing that, he utilizes a very large portion of the heat passing from beneath. I understand from his description that he proposes to do it by the reciprocating plan—to force the waste product from the chamber, and after that chamber has been heated, to reverse and pass the same product through a second chamber, while the supply of hot air has gone back to this highly heated material. That is an original process of working, and utilizes a very large amount of heat which otherwise is drawn into the chimney and wasted. When he can do that, and bring the hot air into the work of combustion in a state of intensity very nearly approximating the intensity of the gases as they issue from the coke furnace, he has comparatively little work to do with the fuel which we use in the coke furnace.

Mr. Greenough—I have been listening to your account of that furnace with interest, and I have also examined with some care the drawings which have appeared in the American Gas Light Journal. Before we arouse ourselves to enthusiasm on the subject, I wish to call your attention to the fact that we really know but little about these results. In his letters, published last summer, Mr. Livesey maintains the advisability of running retorts at a low heat. When I visited his works, two summers ago, he was taking, if I remember rightly, only about 5,000 feet from a retort. If that is all that he is getting from the retorts which he is working by his process, I do not think that he is going to satisfy the demands which we make. I have seen no statement as to whether he is now working in six, four, or three hour charges. A few years ago he was working six hour charges, and I think he is working six now, is he not, Mr. President?

The President—I am inclined to think that he is working four, now.

Major Dresser—My impression is that they are still running six hour charges.

Mr. Greenough—This simply shows that we do not really know what he is doing. He is working, I think, with about 15 per cent. of fuel, but if with that fuel he is only taking out about 5,000 feet per retort, I would like to know that fact before altering our settings into his arrangement.

The President—So should we all; but we do not imagine that on this side of the water we should keep the heat down to such figures as those. So far as the theory of combustion is concerned, it is very closely allied to that of the Liegel furnace, and I do not see that there is any very great difference in making the setting, or in the application of heat to the supplementary air, as he has it in his present furnace. The general build of his furnace does not seem to be very greatly different from that of the Liegel.

Mr. Greenough—The Livesey is inside of the bench, and the Liegel is outside.

The President—The Liegel is partially in the bench and partially in front, I think. We shall have some draughts and figures of the Liegel furnace presently, and perhaps I am too fast in stating it. This is entirely under the bench. It is sunk below the arch. It is cut through the crown of the lower arch, and is built down so that the front of it is flush with the front of the bench proper. His combustion theory is all right there, but I do not think that the introduction of the steam would tend to lower the heat very much, inasmuch as it would only be decomposed at the bottom, and be reburned at the top.

Mr. Greenough—He could arrange the size of the furnace and of the flues in order to obtain a certain intensity of combustion. If he wants his retorts hotter, he will have to alter the size.

The President—He said in his paper that he had such an excess of heat that he proposed to utilize it in the future by putting more retorts in the bench. He has seven in now.

On motion of Mr. Lamson, the thanks of the Association were tendered to Mr. Nettleton for his interesting and instructive paper upon the Dieterich furnace.

APPOINTMENT OF SPECIAL COMMITTEE.

On motion of Mr. Cabot, the resolution of Mr. Stiness relative to appointment of Committee of Arrangements for the annual meeting of the American Gas Light Association was taken from the table for consideration.

There being no objection, Mr. Stiness withdrew the pending resolution and offered the following as a substitute:

Resolved, That a committee consisting of the President and two members be appointed to confer with the Committee of Arrangements of the American Gas Light Association for their October meeting; and that this committee be authorized to draw, upon the order of the President, a sum not exceeding $500 from the invested funds of the Association, to meet any expenses which cannot otherwise be provided for.

The Secretary—I do not understand exactly what is meant by drawing upon the order of the President.

Mr. Stiness—It requires a vote of the Association to draw the money; this resolution places it in the hands of the President to draw the order, and makes him personally responsible for the expenditure.

The Treasurer—I am willing to take considerable more responsibility now than formerly, as I have salary now.

The resolution of Mr. Stiness was unanimously adopted, and the President appointed as members of the committee Messrs. Cabot and Gerould.

The Secretary—In view of the meeting of the American Gas Light Association in Boston in October next, it has been suggested that the semi-annual meeting of this Association be dispensed with; or else that our meeting be held at the the same time as their's, and in connection with it—making it, in fact, a sort of double meeting, although carried on entirely under the auspices of the American Association. In order to Ascertain the sense of the meeting, I move that the semi-annual meeting of our Association be dispensed with this year, for the reasons I have stated.

Mr. Cabot—I move, as an amendment, that the matter of the semi-annual meeting be left with the directors, and that they determine whether we shall have one or not.

Mr. Stiness—I can conceive of contingencies which would render it advisable to have a semi-annual meeting in August. The President and Directors can determine the advisability of such a meeting at some future time. They can dispense with the semi-annual meeting if they deem it best. We cannot forecast what the future will be, and therefore I think it would be better to leave the whole matter in their hands. For that reason I second the amendment of Mr. Cabot.

The Secretary—There is no provision in our Constitution for semi-annual meetings. They have to be authorized by vote of the Association. The Directors are then instructed to make suitable arrangements for the meeting. Unless some authority is now given, I think they cannot, under the By-laws, call a semi-annual meeting. I will withdraw my motion and let the matter be referred to the Directors with full power.

After some further discussion on the subject, it was

Resolved, That the Directors of the Association have power to call a meeting of the Association in August as usual, at some place to be by them determined, if they shall elect to call a semi-annual meeting.

The Association then adjourned until the following morning at 10 o'clock.

[To be continued.]

Report of the Massachusetts State Inspector of Gas and Gas Meters.

OFFICE OF GAS INSPECTION, 32 HAWLEY ST.,
BOSTON, Jan. 19, 1881.

To the Honorable the Senate and House of Representatives, etc.,

The undersigned respectfully submits the following report:

The whole number of meters inspected during the past year was 6,561; 6,439 were either new or had just been repaired. If any of these were found to be incorrect, they were returned for repairs, and then tested again.

The number of meters brought to the office and complained of as incorrect was 122. Of this number 48 registered against the consumer; the average error being 4.54 per cent. Fifty-two were within the limits allowed by law—namely, two per cent. either way, and 22 registered against the company; the average error being 6.59 per cent. The average error of all meters complained of was 0.52 against the consumer.

These were all dry meters. The following table gives the results for the last nine years:

Year.	Fast Meters.		Correct meters.	Slow meters.		Total.	
		Per ct.			Per ct.		Fast.
1872	87	4.30	81	32	9.55	202	0.32
1873	100	5.43	95	40	6.61	238	1.18
1874	101	4.76	131	51	6.22	285	0.57
1875	123	5.99	142	39	8.17	314	1.33
1876	148	5.19	179	53	9.17	381	0.74
1877	93	4.79	125	34	11.00	257	0.28
1878	111	5.34	180	44	9.51	343	0.63
1879	83	5.00	91	18	16.20	193	0.64
1880	48	4.54	52	22	6.59	122	0.52

As will be seen the number of complaints has decreased rapidly during the last two years, and there has been rather less cause for the last year than formerly. The meters thus brought to the office for inspection are in most cases brought at the request of the consumer, and are not to be taken as a fair average of those in use.

Last spring the Legislature passed a law relating to the inspection of gas and gas meters, which embodied the recommendations made in my last annual report, except that the proposed requirements were lowered, owing to representations made by the gas companies to the committee having the bill in charge. The new bill provides an assistant inspector, and calls for two inspections a year of the gas of every company having more than 50 consumers, and one additional inspection for every four million feet of gas manufactured by the company. The gas is required to have an illuminating power of at least 15 candles, and to contain not more than 10 grains of ammonia or 20 of sulphur per 100 feet. No sulphuretted hydrogen, and not more than 10 per cent. of carbonic oxide, is allowed to remain in the gas. All companies making more than 15 million feet of gas are required to furnish photometers away from the works. The law also requires that every meter in use in the State shall be inspected by one of the inspectors.

The new law took effect the 1st of July as regards the inspection of meters, and the 1st of September as regards gas.

Some 22 companies were required to provide photometers satisfactory to the inspector. On the 1st of September only the Boston, Charlestown, Lawrence and Lynn companies were so provided; and the Brookline, Lowell, Roxbury, Springfield and Worcester companies were provided with photometers, requiring generally only minor modifications to make them approved instruments. A large proportion of the other companies had ordered instruments of an approved design; but the orders generally were given but a short time before September.

In the ordinary course of events, the photometers would have been ready in September, or early in October at the latest, and very little delay to the inspections would have resulted; but the candle balances recommended were not supplied by the manufacturer who kept promising them.

After a month or so it was plain that there was no certainty when the desired balances could be obtained; and another make of balance was substituted. After the balances were obtained, there was considerable delay in getting the photometers into working order.

The photometers of the New Bedford and the South Boston companies were ready in October; those of Salem and Fall River, the last of November; those of Cambridge, Newton, and Taunton, in December. The following companies were not provided with the required photometers on January 1st: Chelsea, Dorchester, East Boston, Holyoke and Jamaica Plain. There has been considerable correspondence, verbal and written, with these companies; and the case stands thus—Chelsea and East Boston probably by this time have their photometers in the required condition. Dorchester, Holyoke, and Jamaica Plain have photometers, but do not know where to put them. The law requires that the photometer shall be at least a quarter of a mile from the works, and at Dorchester there is no office away from the works; but I am assured by the president of the company that there is every probability that before the year is far advanced the company will have an office away from the works, where they will place their photometer.

At Holyoke and Jamaica Plain the offices are on the "dead ends" of mains. The companies naturally wish to have their gas show as well as possible, and so do not wish to locate their photometers in their present offices.

In September an accident occurred to one of the small meters used in determining sulphur and ammonia, and about a month was required for its repair.

These delays put back the whole inspection, and made it very difficult, and, in some cases, impossible to make the number of tests required by law. But counting from the time the photometers were provided by the companies, the required number of inspections has been made.

All of the inspections of the gas of the companies manufacturing less than 15 millions a year have been made by means of a portable photometer. The gas of those companies who provided photometers was inspected with more or less regularity from September 1st; the other inspections were almost all made during November and December, which is the time of the greatest consumption of gas, and is therefore the best time in the year to make the test.

I think that, with three exceptions, the gas of every company in the State supplying 50 or more consumers has been inspected. The exceptions are Nantucket and two other companies who did not furnish photometers. These will be inspected early in the year.

No notice has ever been given when the tests were to be made, and the inspections have been distributed in such a manner that it was impossible for the company to tell when they would occur. Whenever practicable, the tests were made at some distance from the works, and only at the following places were the tests made at the works: Amesbury, Arlington, Brockton, Chicopee, Dedham, Dorchester, East Boston, Easthampton, Gloucester, Marblehead, Natick, Plymouth, Wakefield and Westfield.

The greater part of the gas used in this State is made from coal; and for testing this gas Sugg's "London" Argand burner was used, usually No. D, but sometimes Nos. E and F. For testing the gas made at Amesbury, Ipswich, Leominster, Lexington and Southbridge, which is a mixture of petroleum gas and air, and the gas at Middleborough, which is made from rosin, a steatite "batswing" burner was used. The gas was burned at the rate of about 5 feet per hour with the Argand burner, and not far from 3 feet per hour with the "batswing." Attention was always given that the candle was burning properly, and the results are given corrected to a rate of burning of five feet per hour for the gas, and of 120 grains per hour for the candle, on the supposition that the light given is directly proportional to the amount of combustible consumed.

Rather more than half the inspections were made by myself, the remainder being made by the assistant inspector, C. R. Fletcher. At every place requiring more than one inspection, it was intended to have an equal number of tests performed by each of us.

The results given in the following table are the average of inspections made since my last report. The number of tests made at any one place varied from one at the small places, to thirty (Boston), according to the amount of gas used.

The results here given show that the gas furnished the people of this State is usually of fair illuminating power, and generally well purified. Up to the 1st of January no gas tested was found to be below the legal standard of 15 candles, although quite a number of the results were below 16 candles. Much gas is wasted by burning it through improper burners, or, if good burners have been procured, they are frequently allowed to become clogged. Slit burners can be cleaned by a thin strip of brass, or sometimes a strip of writing paper will answer the purpose. Steatite ("lava") is one of the best materials for gas burner tips, as it does not corrode, and conducts heat slowly.

Place or Co.	C. power.	Grs. per 100 ft. Ammo.	Sulphur
Adams	15.6	2—	15.6
Amesbury	17.7	2—	12
Arlington.....	15.7	1	19.4
Athol	16.7	1.4	10.7
Attleborough ...	19.6	2.1	15.1
Beverly	18.2	5.3	11.5
Boston	18.86	5.68	12.06
Brockton.....	17.4	10.6	11 2
Brookline.....	17.5	11.3	6.9
Cambridge.....	16.7	3.7	9.2
Charlestown	16.94	5.8	12.56
Chicopee	16.8	0.7—	12.4
Clinton.....	17.3	2.6	8.9
Danvers.....	17.3	3.9	13.0
Dedha m...	17.7	2.7	13 9
Dorchester	17.1	16.4	17.2
East Boston.....	18.0	6.7	19 4
Easthampton ...	17.8	38.5	14.2
Fall River.....	16.0	50.1	12.1
Fitchburg	16.8	0.8—	13.1
Gloucester	18.4	5.0	—
Gt. Barrington.	16.5	2—	8.1
Greenfield.	16 0	2—	18.8
Haverhill	17.7	4.5	13.5
Holyoke	17.2	0.8—	11.0
Ipswich.....	24.7	0.5—	11
Jamaica Plain..	16.9	39.0	8.4
Lawrence.....	19.94	5.02	14.20
Leominster.....	28.4	—	—
Lexington	29.7	1—	5.7

Place or Co.	C. power.	Grs. per 100 ft. Ammo.	Sulphur
Lowell	15.90	7.43	12.48
Lynn.....	17.62	1.0	8.2
Malden	16.6	2—	7.7
Marblehead.....	17.4	4.2	12.5
Marlborough ...	16.3	0.7	9.9
Middleborough.	25.0	—	—
Milford	15.0	1—	10.4
Natick	16.5	2—	8.1
New Bedford ...	17.8	15.0	8.0
Newburyport ...	16.6	1.8	15.2
Newton...	16.1	6.1	11.2
North Adams ...	16.6	2—	7.7
Northampton ...	16.7	1.2	11.4
N. Attleborough	16.6	2.7	10.9
Pittsfield	16.5	2—	10.2
Plymouth	18.1	2.4	18.9
Quincy.....	18.2	29.4	13.9
Roxbury.....	18.50	4.77	11.05
Salem.....	17.3	4.8	11.2
Southbridge.....	28.8	3—	—
Sonth Boston...	18.32	7.85	9.35
Springfield	16.3	2—	9.0
Taunton.....	17.0	5—	18.4
Wakefield	17.7	6.5	14.2
Waltham	16.5	7.7	11.6
Webster	18.5	2—	5.5
Westfield.....	16.7	2—	15.6
Woburn.....	16 0	1.2	16.3
Worcester.....	15.8	2	16 2

It is impossible to say, from simply looking at a flame, just when it is giving the best effect per unit of gas; but the general conditions are, that the flame should have a rounded outline, and no distinct rays in the centre; or, in other words, that the gas should be burned from comparatively large burner apertures and at low pressures. If this method of burning gas is carried to an extreme, the flame flickers or is smoky.

Only one inspection has been made that showed more than 20 grains of sulphur per 100 feet of gas, and then the excess was only a fraction of a grain; but several have shown more than 19 grains. It is satisfactory to know that the companies are able to keep the amount of sulphur in their gas within the legal limits.

Most of the companies use lime purification, and to this fact may be attributed the small amount of sulphur generally present in the gas. Some few companies use iron purification, and I have observed that when they were producing large quantities of gas it contained considerable sulphur.

Thorough condensation and scrubbing take out considerable sulphur as well as ammonia, and thus decrease the work left for the purifiers.

The only coal gas company whose gas was found to contain sulphuretted hydrogen was at Great Barrington, and there the total amount of sulphur was low. At Amesbury, Lexington and Southbridge traces of sulphuretted hydrogen were detected. At these places a mixture of air and petroleum gas is used, which is washed and condensed, but is not passed through lime or oxide of iron for purification from sulphur compounds. It seems, from the few inspections made, that petroleum gas does contain sulphur compounds, but in small quantity.

Sulphuretted hydrogen is no more harmful than the other sulphur compounds present in gas, as they all finally form sulphuric acid when the gas is burned. The present law prohibits any sulphuretted hydrogen, because its presence in coal gas would show that the gas had not been carefully purified; for sulphuretted hydrogen is readily absorbed by lime or oxide of iron. Petroleum gas is used only in small places, and contains only a small quantity of sulphur, a fraction of which is present as sulphuretted hydrogen.

In view of these facts, it might be well to exempt the small petroleum companies from complying with this part of the law.

The gas at the following places has been found to contain more ammonia than the legal amount of ten grains per 100 feet: Boston, Brockton, Dorchester, Easthampton, Jamaica Plain, Lawrence, Lowell, Quincy and Wakefield once each, and twice at Brookline, Fall River and New Bedford. Most of the other companies, as the table shows, have very little ammonia in their gas, and seem to have little trouble with it. Ammonia can be removed from gas by condensation and washing with water. If both processes are thoroughly conducted, the ammonia can be reduced to a fraction of a grain per 100 feet of gas. The water used for washing the gas is the source of nearly all the ammonia used for industrial purposes.

In Europe they allow very little ammonia to remain in the gas, as it is of considerable value. At present there is not nearly as much demand for ammoniacal salts in this country as there is in England; for there artificial manures are extensively used, and ammonium sulphate is one of their chief ingredients.

One or two manufactories have recently been established in this vicinity for the manufacture of ammonia and its salts, and several of the larger gas companies derive some income from their ammoniacal liquor.

The law allows no gas to contain more than 10 per cent. of carbonic oxide. In former years I have made quite a number of eudiometric analyses, and the results are given in my reports for the years 1873, '75, '77 and '79. This year I thought it desirable to make a few additional analyses to be sure that there had been no considerable change in the character of the gas. The results are given in the following table:

Company.	Boston.	Boston.	Cambridge	Charlestown.	Lowell.
Illuminants ($CnH_2N\&C$).....	6.53	5.73	4.34*	4.82	4.15
Marsh Gas (CH_4).....	42.71	37.64	37.71	36.04	35.65
Hydrogen (H_2).....	44.80	46.50	45.16	49.03	51.16
Carbonic Oxide (CO).....	3.97	7.22	7.92	7.78	6.51
Carbonic Acid (CO_2).....	0.08	0.95	0.04	0.26	0.00
Nitrogen (N_2)	1.70	1.87	4.67	1.90	2.40
Oxygen (O_2).....	0.21	0.00	0.16	0.17	0.13

* This number is somewhat uncertain, as the determination was not satisfactory.

These results show that the gas has the same general composition as in former years. The chief difference seems to be, that these last analyses shows more illuminants than the earlier ones; but I regard this as owing chiefly to the difference in the method of analysis. Formerly the estimation of the illuminants by means of fuming sulphuric acid was a tedious and somewhat uncertain operation. By a modification which I have lately introduced, the accuracy of the method is increased and the time reduced. The Cambridge analysis was performed before the modification was adopted.

In no one of the more than 20 analyses of coal gas I have published does the carbonic oxide amount to 9 per cent., and on the average amounts to about 6½ per cent.

The office at present occupied is fitted up as a laboratory, and contains meter-provers and other apparatus necessary for the performance of the duties of inspection. The office, although small, would answer fairly well, if it were not for the meters sent for inspection from outside the State. These meters are sent, sometimes 60 at a time, packed in boxes with straw. For want of room these boxes have to be unpacked in the laboratory, which is thus kept dusty much of the time; and, until the meters are inspected and sent away, no other work can be done.

Most of the meters are inspected by the deputy inspector of meters, as the inspector and assistant inspector are fully occupied with testing gas when most of the meters are required to be inspected. Provision is made for the payment of the deputy by means of fees. These fees, although sufficient, are very irregularly distributed through the year. At some seasons there are very few meters to be inspected, and at others the deputy is unable to meet all the demands for inspection.

It would seem to be a much better way to give the deputy a fixed salary, to be levied on the companies in the same manner as the salaries of the inspector and assistant are at present, and to devote the proceeds of the inspection of meters—first, to providing a suitable office and laboratory, and then to travelling expenses, apparatus, chemicals, etc., any excess to go towards paying salaries, and any deficiency to be made up by a levy on the companies, as at present provided for. The proposed arrangement is at present in operation at Washington, D. C.

Respectfully,
CHARLES W. HINMAN.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Gas Matters on the Pacific Coast.

To the Editor AMERICAN GAS LIGHT JOURNAL:

I have for some time intended to furnish your readers with an account of gas matters on the Pacific Coast, and feel satisfied that (like the dry goods men) I can offer them some "novelties."

THE MARE ISLAND PIPE LINE.

About three years ago, Mr. J. K. Duncan, President Vallejo Gas Light Company, sent for me to carry out his wish of adding the Mare Island Navy Yard to his list of consumers.

The Island is separated by a tidal strait of 1400 feet in width, and considerable velocity of flow, from the city of Vallejo; and there was an opposition by influential men to any project which would stop the Government's purchases of gasoline, by which the yard was mainly lighted.

Either obstacle was serious; but the prize was an added consumption of about 4000 cubic feet per diem—a big boon to a little company supplying less than 150 consumers. So we went to work with a will.

The first and most evident difficulty was the trapping off by condensation; and our first inquiry was into the cost of driving a line of piles, and cutting them off under water to such heights as to give a gradual fall to a pipe strapped on their heads from the Vallejo side to the Mare Island side, where

the drip-pot was to be placed. The water was deepest in the centre of the channel, so that a very considerable trench (to be cut under water, partly in mud, partly in solid ground, and partly in rock), was a necessary part of the project. Divers and sundry pile drivers, excavators, submarine explorers, blasting powder and electric exploders were to form part of the programme, and united to run up the estimates of cost to a figure which led Mr. Duncan's scant hair to stand erect, and put an eternal estoppel on that little game as you may well suppose.

Mr. Duncan then instructed me to estimate the cost of passing the gas over, under tension, in a cylinder to be fixed on the ramshackle ferryboat which plies between the city and the yard. This plan involved an engine and pump, and was, in turn, abandoned, after a close discussion of its first cost and probable working.

The consideration of these two modes, of course, occupied time, and it was not until January 1st, 1880, that our diligent incubation hatched a method which has more recently been put in effect.

The engine and pump necessary to the second idea led to the thought that it would be easy to pump even a steady flow of massive water across, and that it was a mere question of quantity of power applied to keep the pipe free of condensed liquid without the interposition of any vessels whatever to receive the drip.

The use of an Otto silent engine, to drive the pump or compressor, was a manifest corollary; and the only part of the problem which concerns an engineer was substantially solved by means so obvious as to astonish us that its simplicity had not first of all been observed. So far as my part of it was concerned, a few hours' calculation of speeds, powers and volumes proved its feasibility, and Mr. Duncan made the requisite arrangements with the authorities at the Navy Yard and in Washington.

The apparatus consisted of—

A. A four horse-power Otto silent gas engine, a 6″×8″ upright engine, converted into a compressor by changing its valves, an equalizing cylinder, and a 100-feet gasholder, fed from the pressure side of the pump, to feed in turn the igniters of the gas engine.

B. A line of 2-inch galvanized wrought-iron pipe, laid 800 feet along Georgia street wharf on the Vallejo side to the compressor, 1400 feet on the bottom of the strait to cross, and 600 feet from the landing on the Mare Island side to the distributing holder.

C. A station meter at the inlet of the Mare Island holder.

The pumping apparatus being set, and connected to the Georgia street main, it only remained to get the pipe across.

We stretched a cable clear across the strait, and attempted to make the joints (which were protected, after being screwed up by leaded sleeves) from a barge secured by travellers to the standing cable; but the water was swift, and wide and deep, and a boat load of jolly tars, full of alcoholic impatience, put knife to cable, and so our maiden effort came suddenly to grief; and all we won was a set of complex twists and turns in the pipe fit to make one sick.

The next day we landed our 200 feet of spoiled pipe, and adopted a plan suggested by Mr. P. B. Fagan, the gas company's superintendent. This was to pass over the cable as before, but under water instead of above, making the capstan of a schooner, moored to the Mare Island wharf, do the work.

We fastened the Vallejo end of the cable to the blank end of the pipe, and so pulled the pipe across, making joint after joint on a barge secured to the Vallejo side. We fed out the pipe according to the strain of the capstan, and had no further trouble. We landed the pipe and found the whole length to be perfectly dry and tight, without a single broken or stripped thread, or any symptom whatever which might result in trouble.

The necessary connections were completed, and the thing was done.

The Navy Yard has in this way been supplied since September 1st, 1880, with a 17-candle coal gas; but I have deferred sending you any account of the matter until we should demonstrate practically, and by months of work, whether the bugbear of condensation was completely wiped out.

I believe that Mr. Duncan explained the project to some of my gas friends in the East, during his preliminary visit to Washington, and they may be glad to hear of its success.

During the month of January, 1881, 5000 cubic feet were used to drive the engine, and 150,500 cubic feet were pumped across to the Navy Yard.

No additional labor was employed, and beyond some trifling allowance for oil, and wear and tear, each 1000 cubic feet pumped over cost but 6¼ cents added to its cost in the holder at the works.

While this work was being done, the station works of the Vallejo Gas Light Company were improved by the addition of a Pélouze & Audouin condenser, a scrubber, and a station meter and jet photometer.

WOODEN GASHOLDER TANKS.

Nearly all gasholder tanks of less diameters than 50 feet are built, in California, of redwood lumber.

Some of these tanks are from 15 to 22 years old, and are, to all appearance, as sound as when first erected. With the experience I have had with them, I infinitely prefer them to brick, at three times the cost, especially in an earthquake country.

Where the indestructible redwood is to be procured, I would not hesitate to build a wooden tank 120 feet in diameter; and even with you there can be no objection to using "treated" pine. If any engineers care to correspond with me in regard to this important saving of capital, I will be glad to hear from them.

A PHASE OF WATERED GAS.

During the recent floods, due to an almost unprecedented rainfall, the Oroville gas works (in this state) embarked on the raging Feather River, and went down stream, lock, stock and barrel, as an unexpected mess of pipes, gasholder iron and brickbats. We don't do things half way out West you observe.

THE HOTEL DEL MONTE GAS WORKS.

These works were built by me during 1880, and are a very highly-finished specimen of work. Their product is coal gas of 36 candles, measured by the illuminating power meter; and, for splendor of light, surpasses any gas I have ever seen, save one.

Yours,

J. R. Smedberg.

San Francisco, Feb. 17, 1881.

Toronto Gas.

To the Editor American Gas Light Journal:

My name having been freely used in your Journal, by Mr. Pearson, Secretary of the Toronto Gas Company, I beg space for a brief rejoinder.

As Mr. Pearson had stated publicly that "they had no trouble with gas in warm weather," I drew his attention publicly also to these facts, 1st, that in August last my burners were clogged; 2d, that twice in hot weather men from the gas works came to clear out my service pipes or burners; 3d, that they found therein "a tarry, viscous substance." Mr. P. replies, "A man was sent to Mr. H.'s residence in July, and another in August, and reported that the trouble was from their being closed with a carboniferous deposit." Yet this same Mr. P. had stated in public that no trouble existed in warm weather! Of course, Mr. P.'s words read that the men were closed up with a "carboniferous deposit"; but that was not the kind of trouble he alluded to, so, I suppose, this marvelous deposit was in the gas pipes. I leave geologists and chemists to settle what "a carboniferous deposit" in a gas burner is, it would be an acquisition to their museums.

Again, Mr. P. states, in proof that "they had no trouble in warm weather," that the gas men went to my house "on October 5th and blew naphthaline into the mains." Now, up to October 5th, for a month before, the temperature averaged about 58°, or 26° above freezing; so Mr. P. admits that his company is making gas which will not work at so moderate a temperature, as he positively excuses the pipes being choked on account of the cold prior to October 5th! He had better shift his apparatus to the tropics—it is manifestly not suited to a climate averaging only 45° for the year, and where only for three months (when gas is not needed) the temperature is high enough for Mr. P.'s gas to work without "trouble."

Mr. P. does not deny that a viscous tarry substance was in my gas pipes, he, as he thinks, ingeniously denies that I saw it "as it was blown into the mains." I beg to say that I saw it before it was blown away, and felt it, and smelt it.

Mr. P. also denies that gas by the Lowe Process was ever made in England; this is also a smart but not straightforward statement. I did not say the Lowe Process was used in England; but for Mr. P.'s information and the public's, I now say that I saw in England the same process as Lowe's, under a different name, many years ago.

Mr. P. is not scientific in his gas operations, and no person could suppose him to be who reads his letters, as they are loosely worded, full of inaccuracies and contradictions, and words are freely used by him, of a scientific and literary character, which he is manifestly not so familiar with as to use correctly. But let him give me good gas, and I will pardon his grammar most freely.

Yours, etc.,

John Hague.

Mining Pump Machinery.—The Yellow Jacket mine engine cost $500,000. Mining men have been trying for a long time to devise some less expensive and cumbersome pumping machinery. At last a new system has been invented, which, it is claimed, will prove a success and reduce the cost of machinery 90 per cent. By the new system there extends from top to bottom of the mine an endless wire rope, which, at the various pumping stations, passes around large pulleys 15 feet in diameter. To these pulleys are attached shafts driving the pistons of the pumps. The engine sets everything going, as on wire cable street railroads. This machinery can be driven by an engine consisting of two sixteen inch cylinders with a four foot stroke. —*Coal Trade Journal.*

THE AMERICAN GASLIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.

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WEDNESDAY, MARCH 16, 1881.

Official Report of Examinations of Gas for two Weeks ending March 12, 1881, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

1881. Feb.	Time of Day at which Test were made.	New York Gas-Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
		†	*	†	‡	*	†
28		25.09	18.44	23.92	24.69	20.74	30.66
Mar. 1	Between	24.32	19.38	26.81	24.60	19.53	29.39
2	9.30 A.M.	26.71	18.66	26.52	24.12	19.28	31.46
3	and	24.28	18.54	27.63	24.35	19.41	30.57
4	1 P. M.	27.18	19.38	27.51	24.72	19.49	29.99
5		29.50	19.79	27.10	24.50	19.31	32.04
	Average	26.18	19.03	26.58	24.49	19.62	30.68
7		27.17	19.20	24.18	25.28	18.54	30.81
8		26.88	19.49	26.92	22.86	19.66	30.63
9		24.62	19.00	25.25	22.73	19.04	30.41
10		22.54	18.64	23.98	22.44	18.41	27.76
11		25.42	19.62	25.29	23.99	18.96	32.04
12		25.01	18.84	25.17	23.06	19.04	30.46
	Average	25.27	19.13	25.13	23.39	18.94	30.35

* Five foot lava tip with check.
† Bray's slit union, No. 7.
‡ Bray's slit union, No. 6.

E. G. LOVE, Gas Examiner.

Purchase of the Jamestown (N. Y.) Gas Works.

Our enterprising townsman, A. F. Kent, has just completed the purchase of the Jamestown, N. Y., gas works, of which he gets possession May 1st next. We can assure the people of that city that they will be liberally and satisfactorily dealt with, and popular prices the rule of the new management. Mr. Kent conducts the gas business as he did his whilom dry goods trade, on strictly business principles. He is a practical gas works builder, and master of the business in all its details, as the works at Corry, Warren, and this city attest. We understand that it is his intention to thoroughly rebuild the Jamestown works, putting in a new plant of retorts, and generally modernizing them. He still retains his interest here, and will still supervise the works here, spending a portion of his time in each city.—*Oil City Derrick*, Feb. 7.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)
34 PINE STREET, NEW YORK CITY.
MARCH 16, 1881.

☞ All communications will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid.	Asked
Gas Co.'s of N. Y. City.				
Central	$166,000	50	60	65
Harlem	1,800,000	50	63	68
" Bonds	170,000			103
Manhattan	4,000,000	50	187	190
Metropolitan	2,500,000	100	143	147
" Scrip	1,000,000	...	102	103x
Mutual	5,000,000	100	65	70
" Bonds, go'd.	900,000	1000	100	104
Municipal	1,500,000	100	157	160
" Bonds	750,000		106	110
New York	4,000,000	100	96	99
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	110	115
Citizens	1,200,000	20	45	50
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal	1,500,000	100	55	60
Peoples	1,000,000	10	25	30
" Bonds	290,000	...	101	104
" "	250,000	...	70	75
Metropolitan	1,000,000	100	55	60
Nassau	1,000,000	25	45	48
" Ctfs.	700,000	1000	95	100
Williamsburgh	1,000,000	50	60	64
" Bonds		...	98	103
Kings Co	135,000	100	55	60
" Bonds	40,000	—	—	—
Richmond Co., S. I.	300,000	...	70	75
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	72	76
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.			178	180
Consolidated, Balt.			71	72
Bonds			107	—
East Boston, Mass		25	114	120
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	144
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
Jersey City	750,000	20	140	150
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	—	100
Laclede St Louis Mo.	1,200,000	100	108	110
Montreal, Canada	2,000,000	100	153	154
New Haven, Conn		25	132	—
Oakland, Cal			33	34
Peoples, Jersey City		...	85	90
" " Bds.			-	5
Pittsfield, Mass			120	130
Rochester, N. Y.		50	70	80
" Citizens		100	30	35
Woonsocket, R. I.	150,000	100	80	...
Wilmington, Del.		50	174	...
Yonkers		50	—	70
Rondout & Kingston			75	80
St. Louis Missouri	600 000	50	250	254
San Francisco Gas-Co., S. Fr'sco Cal.			76	77
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C.	1,500,000	20	190	200
" Scrip	500,000	20	150	160

100 shares Manhattan, at auction, at 189; also, 25 shares Metropolitan, at 147.

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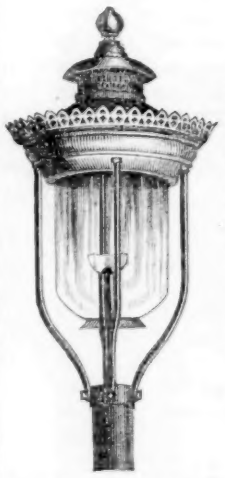

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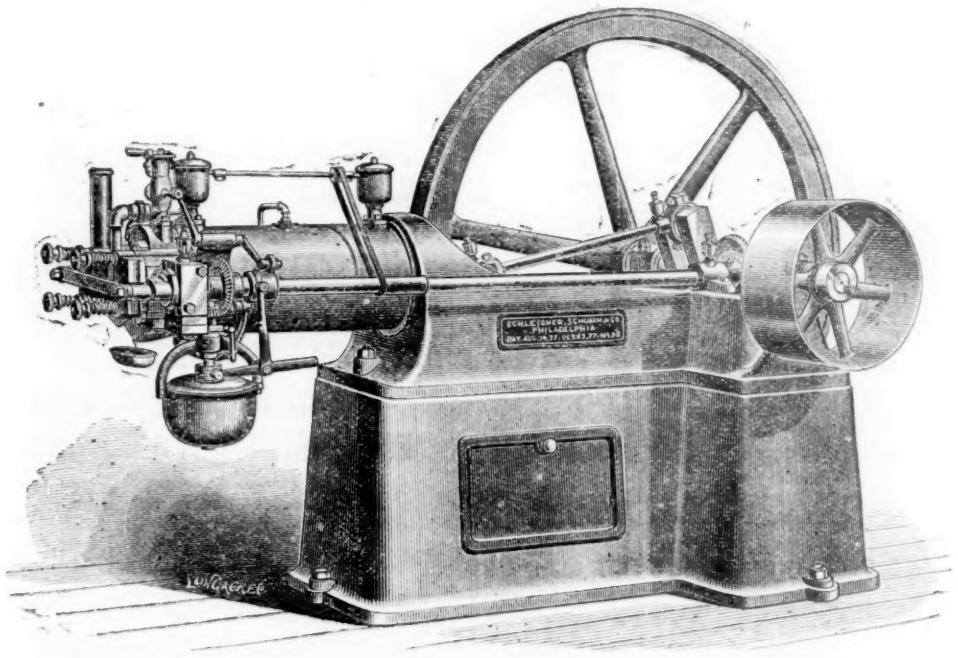

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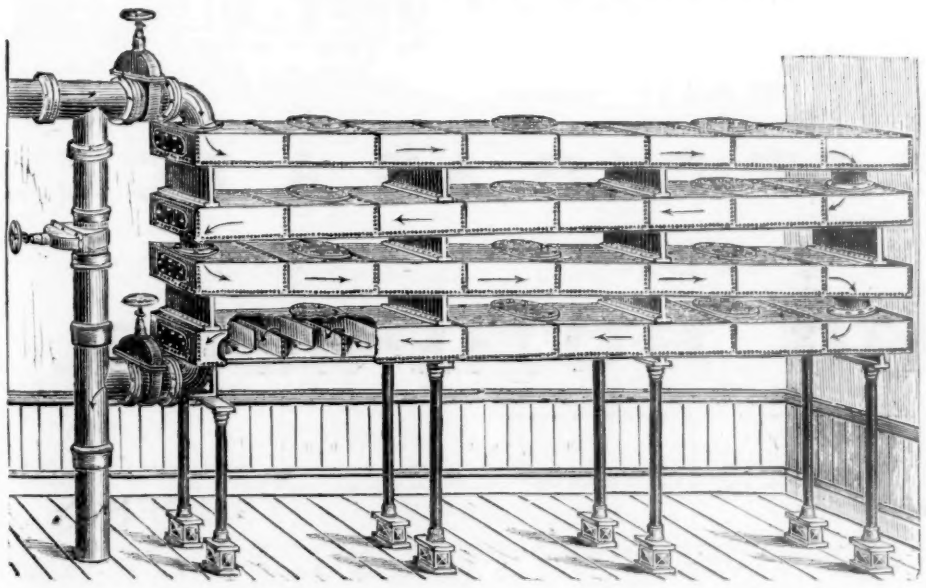

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See pages 150 and 151 of the "American Gas Light Journal" of April 2, 1879. For estimates of cost, address,

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HENRY MAURER,
Excelsior Fire Brick & Clay Retort Works
CLAY GAS RETORTS, BENCH SETTINGS, FIRE BRICK, TILES, ETC.

THE
ECONOMY OF GAS AS A FUEL
FOR
COOKING PURPOSES.

This is a small Pamphlet containing the Paper read by
MR. WILLIAM W. GOODWIN, OF PHILADELPHIA, PA.,
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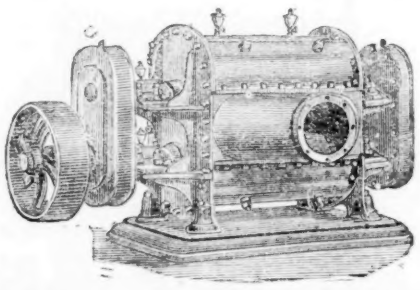

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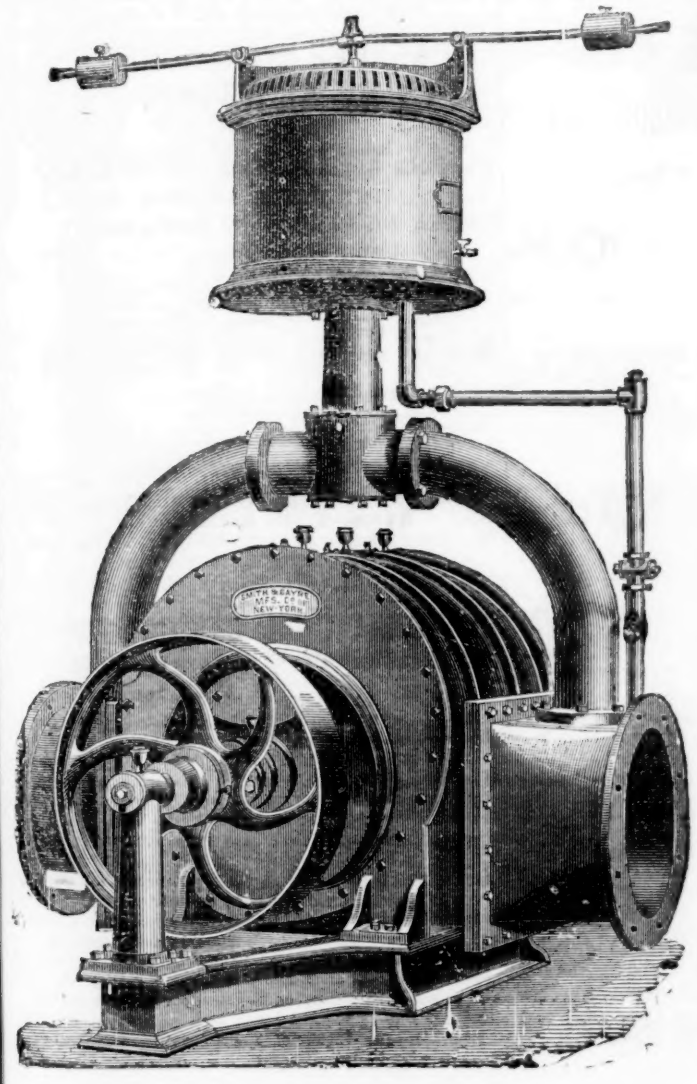

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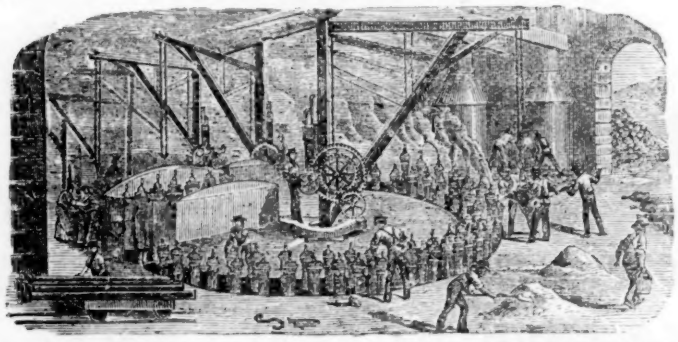

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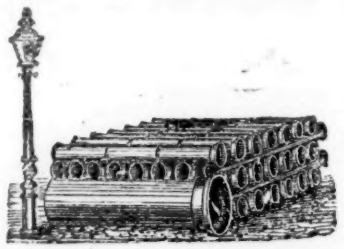

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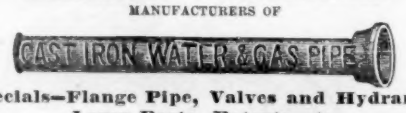

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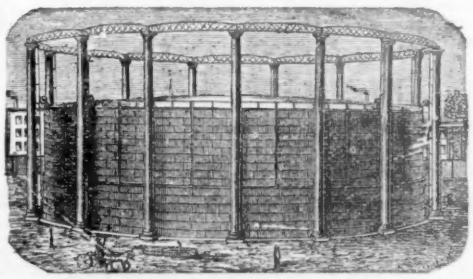

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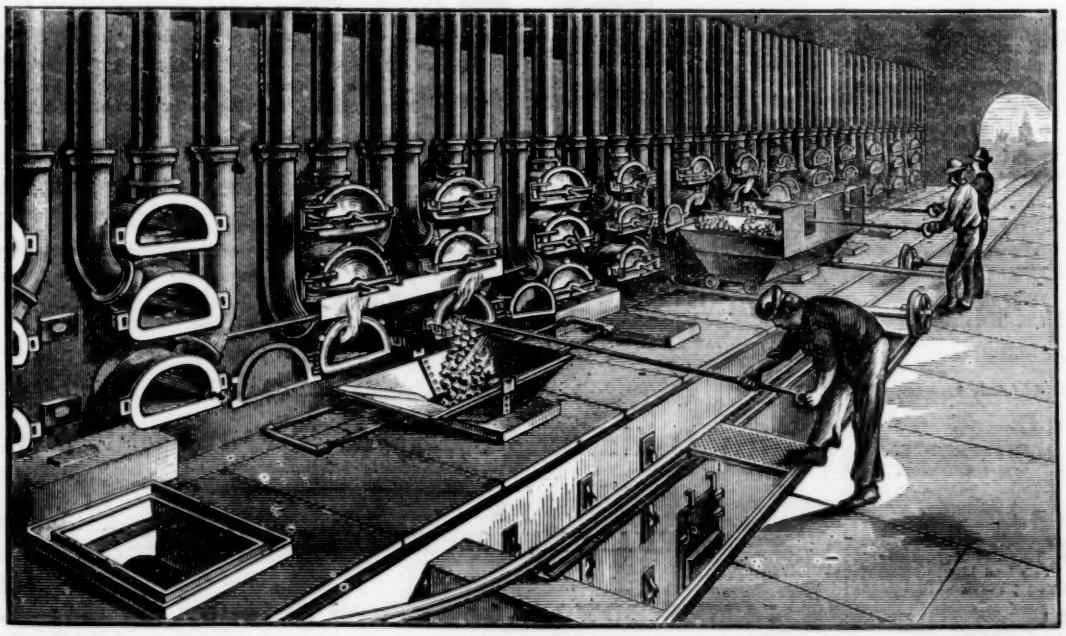

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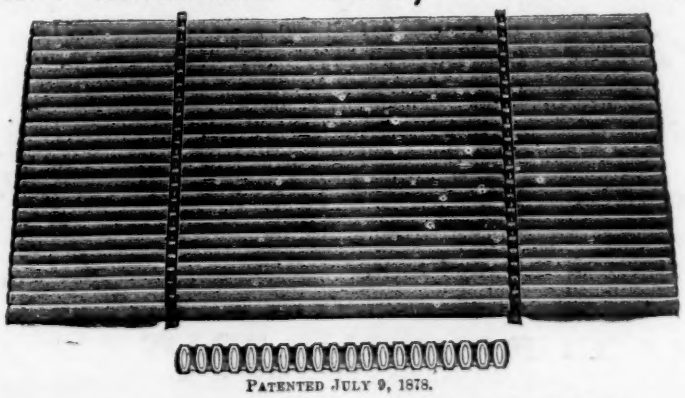

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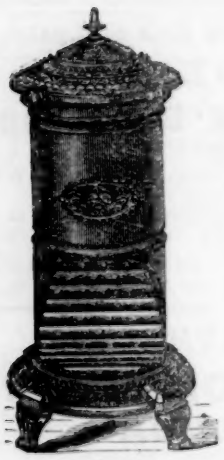

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